WHAT IS CLAIMED IS:

1. A light-scanning optical apparatus comprising:

an incidence optical system adapted to cause a light beam emitted from a light source to strike a deflection plane of an optical deflector with a predetermined angle in the sub-scanning section; and

a focussing optical system for focussing the light beam reflected by the deflection plane of the optical deflector on a surface to be scanned;

said focussing optical system including an fθ lens system having a spherical lens and a first cylindrical lens showing power in the main-scanning direction and an optical system showing power in the sub-scanning direction;

said spherical lens and said first cylindrical lens also constituting part of said incidence optical system.

2. A light-scanning optical apparatus according to claim 1, wherein

the requirements of conditional formulas (1) and (2) below are satisfied:

$$\left| \frac{(N1-1)}{R2} \cdot F \right| < 0.15 \qquad (1)$$

and

$$\left| \frac{(N2-1)}{R3} \cdot F \right| < 0.15 \qquad (2)$$

where

F: the focal length of the fθ lens system in the main-scanning direction,

R2: the radius of curvature of the surface of the spherical lens facing the surface to be scanned,

R3: the radius of curvature of the surface of the first cylindrical lens facing the optical deflector as viewed in the main-scanning direction,

N1: the refractive index of the material of the spherical lens at the operating wavelength and

N2: the refractive index of the material of the first cylindrical lens at the operating wavelength.

3. A light-scanning optical apparatus according to claim 2, wherein

the left side of the conditional formula (1) and the left side of the conditional formula (2) satisfy the requirement

$$\left| \frac{(N2-1)}{R3} \cdot F \right| < \left| \frac{(N1-1)}{R2} \cdot F \right| .$$

4. A light-scanning optical apparatus according to claim 2, wherein

the requirement of conditional formula below is satisfied:

$$0.86 < N1 / N2 < 0.92 \qquad (3).$$

5. A light-scanning optical apparatus according

to claim 2, wherein

the requirement of the conditional formula below is satisfied:

$$0.05 < DO / F < 0.08 \quad (4),$$

where

DO: the distance between the deflection plane of the optical deflector and the spherical lens.

6. A light-scanning optical apparatus according to claim 2, wherein

the requirement of the conditional formula below is satisfied:

$$0.15 < \frac{(D1/N1 + D2 + D3/N2)}{F} < 0.20 \quad (5),$$

where

D1: the thickness of the spherical lens,

D2: the distance between the spherical lens and the first cylindrical lens and

D3: the thickness of the first cylindrical lens.

7. A light-scanning optical apparatus according to claim 2, wherein

the light beam emitted from the light source strikes the deflection plane of the optical deflector substantially along the center line of the deflection angle of the optical deflector.

8. A light-scanning optical apparatus according to claim 2, wherein

the light beam emitted from the light source strikes the deflection plane of the optical deflector with a width broader than that of the deflection plane in the main-scanning direction.

9. A light-scanning optical apparatus according to claim 2, wherein

said optical system showing power in the sub-scanning direction has a second cylindrical lens showing power in the sub-scanning direction.

10. A light-scanning optical apparatus according to claim 1, wherein

said optical system showing power in the sub-scanning direction has a second cylindrical lens; and

the light beam at image height = 0 is made to pass through a position off the optical axis of the second cylindrical lens in the sub-scanning section.

11. A light-scanning optical apparatus according to claim 10, wherein

the direction vector of the light beam reflected by the deflection plane at image height=0 and the optical axis of the second cylindrical lens are made to show a predetermined angle.

12. A light-scanning optical apparatus according to claim 10, wherein

the perpendicular to the deflection plane at image height = 0, the optical axis of the spherical lens and that of the first cylindrical lens are parallel with each other in the sub-scanning section.

13. A light-scanning optical apparatus according to claim 10, wherein

the perpendicular to the deflection plane at image height=0 and the optical axis of the first cylindrical lens are parallel with each other in the sub-scanning section; and,

if the direction vector of the light beam entering the deflection plane at image height=0 and the direction vector of the light beam reflected by the deflection plane are expressed respectively by $\alpha 1$ and $\alpha 2$ and the direction vector of the optical axis of the spherical lens is expressed by β, the requirement of the conditional formula below is satisfied:

$$|\alpha 1 \cdot \beta| > |\alpha 2 \cdot \beta| .$$

14. A light-scanning optical apparatus according to claim 10, wherein

the light beam reflected by the deflection plane at image height = 0, the optical axis of the spherical lens and that of the first cylindrical lens are

parallel with each other in the sub-scanning section.

15. A light-scanning optical apparatus according to claim 10, wherein

the light beam emitted from the light source strikes the deflection plane of the optical deflector with a width broader than that of the deflection plane in the main-scanning direction.

16. A light-scanning optical apparatus according to claim 10, wherein

the light beam emitted from the light source strikes the deflection plane of the optical deflector substantially along the center line of the deflection angle of the optical deflector.

17. A light-scanning optical apparatus comprising:

an incidence optical system adapted to cause a light beam emitted from a light source to strike a deflection plane of an optical deflector with a predetermined angle in the sub-scanning section; and

a focussing optical system for focussing the light beam reflected by the deflection plane of the optical deflector on a surface to be scanned;

said focussing optical system including an fθ lens system having a spherical lens and a first cylindrical

lens showing power in the main-scanning direction and an optical system showing power in the sub-scanning direction;

said focussing optical system satisfying the requirements of conditional formulas (1) and (2) below:

$$\left| \frac{(N1-1)}{R2} \cdot F \right| < 0.15 \quad (1)$$

and

$$\left| \frac{(N2-1)}{R3} \cdot F \right| < 0.15 \quad (2),$$

where

F: the focal length of the fθ lens system in the main-scanning direction,

R2: the radius of curvature of the surface of the spherical lens facing the surface to be scanned,

R3: the radius of curvature of the surface of the first cylindrical lens facing the optical deflector as viewed in the main-scanning direction,

N1: the refractive index of the material of the spherical lens at the operating wavelength and

N2: the refractive index of the material of the first cylindrical lens at the operating wavelength.

18. A light-scanning optical apparatus according to claim 17, wherein

the left side of the conditional formula (1) and the left side of the conditional formula (2) satisfy

the requirement

$$\left| \frac{(N1-1)}{R2} \cdot F \right| < \left| \frac{(N2-1)}{R3} \cdot F \right|$$

19. A light-scanning optical apparatus according to claim 17, wherein

the light beam emitted from the light source strikes the deflection plane of the optical deflector with a width broader than that of the deflection plane in the main-scanning direction.

20. A light-scanning optical apparatus according to claim 17, wherein

said spherical lens and said first cylindrical lens also constitute part of said incidence optical system.

21. A light-scanning optical apparatus according to claim 17, wherein

the light beam emitted from the light source strikes the deflection plane of the optical deflector substantially along the center line of the deflection angle of the optical deflector.

22. A light-scanning optical apparatus according to claim 17, wherein

said optical system showing power in the sub-scanning direction has a second cylindrical lens

showing power in the sub-scanning direction.

23. A light-scanning optical apparatus comprising:

an incidence optical system adapted to cause a light beam emitted from a light source to strike a deflection plane of an optical deflector with a predetermined angle in the sub-scanning section; and

a focussing optical system for focussing the light beam reflected by the deflection plane of the optical deflector on a surface to be scanned;

said focussing optical system including an fθ lens system having a spherical lens and a first cylindrical lens showing power in the main-scanning direction and an optical system showing power in the sub-scanning direction;

the light beam emitted from the light source being made to strike the deflection plane of said optical deflector with a width broader than that of the deflection plane in the main-scanning direction.

24. A light-scanning optical apparatus according to claim 23, wherein

the requirements of conditional formulas (1) and (2) below are satisfied:

$$\left| \frac{(N1-1)}{R2} \cdot F \right| < 0.15 \qquad (1)$$

and

$$\left| \frac{(N2-1)}{R3} \cdot F \right| < 0.15 \qquad (2)$$

where

F: the focal length of the fθ lens system in the main-scanning direction,

R2: the radius of curvature of the surface of the spherical lens facing the surface to be scanned,

R3: the radius of curvature of the surface of the first cylindrical lens facing the optical deflector as viewed in the main-scanning direction,

N1: the refractive index of the material of the spherical lens at the operating wavelength and

N2: the refractive index of the material of the first cylindrical lens at the operating wavelength.

25. A light-scanning optical apparatus according to claim 24, wherein

the left side of the conditional formula (1) and the left side of the conditional formula (2) satisfy the requirement

$$\left| \frac{(N1-1)}{R2} \cdot F \right| < \left| \frac{(N2-1)}{R3} \cdot F \right|$$

26. A light-scanning optical apparatus according to claim 23, wherein

said spherical lens and said first cylindrical lens also constitute part of said incidence optical

system.

27. A light-scanning optical apparatus according to claim 23, wherein

the light beam emitted from the light source strikes the deflection plane of the optical deflector substantially along the center line of the deflection angle of the optical deflector.

28. A light-scanning optical apparatus according to claim 23, wherein

said optical system showing power in the sub-scanning direction has a second cylindrical lens showing power in the sub-scanning direction.

29. An image forming apparatus comprising:

a light-scanning optical apparatus according to any of claims 1 through 28;

a photosensitive member arranged on said surface to be scanned;

a developing unit for developing an electrostatic latent image formed on said photosensitive member by a light beam caused to scan by said light-scanning optical apparatus into a toner image;

a transfer unit for transferring said developed toner image onto a toner image receiving member; and

a fixing unit for fixing the transferred toner

image on the toner image receiving member.

30. An image forming apparatus comprising:

a light-scanning optical apparatus according to any of claims 1 through 28; and

a printer controller for transforming code data input from an external device into an image signal and input it into said light-scanning optical apparatus.

31. A light-scanning optical apparatus comprising:

an incidence optical system adapted to cause a light beam emitted from a light source to strike a deflection plane of an optical deflector with a predetermined angle in the sub-scanning section; and

a focussing optical system for focussing the light beam reflected by the deflection plane of the optical deflector on a surface to be scanned;

said focussing optical system including an fθ lens system having a lens showing power both in the main-scanning direction and in the sub-scanning direction and a first cylindrical lens showing power in the main-scanning direction and an optical system showing power in the sub-scanning direction;

said lens showing power both in the main-scanning direction and in the sub-scanning direction and said first cylindrical lens also constituting part of said

incidence optical system.

32. A light-scanning optical apparatus according to claim 31, wherein

said lens showing power both in the main-scanning direction and in the sub-scanning direction is a spherical lens.

33. A light-scanning optical apparatus according to claim 32, wherein

the requirements of conditional formulas (1) and (2) below are satisfied:

$$\left| \frac{(N1-1)}{R2} \cdot F \right| < 0.15 \qquad (1)$$

and

$$\left| \frac{(N2-1)}{R3} \cdot F \right| < 0.15 \qquad (2)$$

where

F: the focal length of the fθ lens system in the main-scanning direction,

R2: the radius of curvature of the surface of the spherical lens facing the surface to be scanned,

R3: the radius of curvature of the surface of the first cylindrical lens facing the optical deflector as viewed in the main-scanning direction,

N1: the refractive index of the material of the spherical lens at the operating wavelength and

N2: the refractive index of the material of the first cylindrical lens at the operating wavelength.

34. A light-scanning optical apparatus according to claim 33, wherein

the left side of the conditional formula (1) and the left side of the conditional formula (2) satisfy the requirement

$$\left| \frac{(N2-1)}{R3} \cdot F \right| < \left| \frac{(N1-1)}{R2} \cdot F \right|$$

35. A light-scanning optical apparatus according to claim 31, wherein

the light beam emitted from the light source strikes the deflection plane of the optical deflector substantially along the center line of the deflection angle of the optical deflector.

36. A light-scanning optical apparatus according to claim 31, wherein

the light beam emitted from the light source strikes the deflection plane of the optical deflector with a width broader than that of the deflection plane in the main-scanning direction.

37. A light-scanning optical apparatus according to claim 31, wherein

said optical system showing power in the sub-

scanning direction has a second cylindrical lens showing power in the sub-scanning direction.

38. A light-scanning optical apparatus comprising:

an incidence optical system adapted to cause a light beam emitted from a light source to strike a deflection plane of an optical deflector with a predetermined angle in the sub-scanning section; and

a focussing optical system for focussing the light beam reflected by the deflection plane of the optical deflector on a surface to be scanned;

said focussing optical system including an fθ lens system having a lens showing power both in the main-scanning direction and in the sub-scanning direction and a first cylindrical lens showing power in the main-scanning direction and an optical system showing power in the sub-scanning direction;

the light beam emitted from the light source being made to strike the deflection plane of said optical deflector with a width broader than that of the deflection plane in the main-scanning direction.

39. A light-scanning optical apparatus according to claim 38, wherein

said lens showing power both in the main-scanning direction and in the sub-scanning direction is a

spherical lens.

40. A light-scanning optical apparatus according to claim 38, wherein

the requirements of conditional formulas (1) and (2) below are satisfied:

$$\left| \frac{(N1-1)}{R2} \cdot F \right| < 0.15 \quad (1)$$

and

$$\left| \frac{(N2-1)}{R3} \cdot F \right| < 0.15 \quad (2)$$

where

F: the focal length of the fθ lens system in the main-scanning direction,

R2: the radius of curvature of the surface of the spherical lens facing the surface to be scanned,

R3: the radius of curvature of the surface of the first cylindrical lens facing the optical deflector as viewed in the main-scanning direction,

N1: the refractive index of the material of the spherical lens at the operating wavelength and

N2: the refractive index of the material of the first cylindrical lens at the operating wavelength.

41. A light-scanning optical apparatus according to claim 38, wherein

the left side of the conditional formula (1) and

the left side of the conditional formula (2) satisfy the requirement

$$\left| \frac{(N2-1)}{R3} \cdot F \right| < \left| \frac{(N1-1)}{R2} \cdot F \right|$$

42. A light-scanning optical apparatus according to claim 38, wherein

said spherical lens and said first cylindrical lens constitute part of said incidence optical system.

43. A light-scanning optical apparatus according to claim 38, wherein

the light beam emitted from the light source strikes the deflection plane of the optical deflector substantially along the center line of the deflection angle of the optical deflector.

44. A light-scanning optical apparatus according to claim 38, wherein

said optical system showing power in the sub-scanning direction has a second cylindrical lens showing power in the sub-scanning direction.

45. An image forming apparatus comprising:

a light-scanning optical apparatus according to any of claims 31 through 44;

a photosensitive member arranged on said surface to be scanned;

latent image formed on said photosensitive member by a light beam caused to scan by said light-scanning optical apparatus into a toner image;

a transfer unit for transferring said developed toner image onto a toner image receiving member; and

a fixing unit for fixing the transferred toner image on the toner image receiving member.

46. An image forming apparatus comprising:

a light-scanning optical apparatus according to any of claims 31 through 44; and

a printer controller for transforming code data input from an external device into an image signal and input it into said light-scanning optical apparatus.

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